Final Report

Environmental Advisory Committee on
Newfoundland and Labrador Marine Transportation
(EACNLMT)

1984-1989

(Response to Recommendation No. 80, Beaufort Sea
Environmental Assessment and Review Panel)

September 1989

Environment Canada

Fisheries and Oceans

Indian Affairs and Northern Development

Government of Newfoundland & Labrador

Labrador Inuit Association

Canadian Petroleum Association

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This report was prepared as a response to Recommendation No. 80 of the Beaufort Sea Environmental Assessment and Review Panel, based on the deliberations of the Environmental Advisory Committee on Newfoundland and Labrador Marine Transportation (EACNLMT) between 1984 and 1989.

The contents of the report do not necessarily reflect the views and policies of the companies, government agencies and interest groups represented on the Committee.

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SECTION A: DELIBERATIONS AND RECOMMENDATIONS

1.0 INTRODUCTION

In 1980, the Department of Indian Affairs and Northern Development initiated a formal public review of a proposed oil development project in Canada's Arctic under the federal Environmental Assessment and Review Process. The project included production of oil from the Beaufort Sea and transport of the oil to southern markets by pipeline, tanker or both. The federal Minister of the Environment appointed the Beaufort Sea Environmental Assessment Panel in 1981 to review the activities involved, to identify potential impacts of the project and to recommend mitigative measures. The review included only activities north of 60°N latitude.

In a submission to the Assessment Panel, the Government of Newfoundland and Labrador and the Labrador Inuit Association proposed a public review of the effects of potential tanker traffic in east coast waters south of 60°N. The Assessment Panel responded that such a review was not within its mandate and recommended in its report that the federal Minister of the Environment either:

(a) appoint, with the Government of Newfoundland and Labrador, an independent review body to conduct a public review on the environmental and socio-economic effects of tanker traffic in the Labrador Sea; or

(b) sponsor a review of this issue at a conference called for that purpose to be held in Newfoundland. Recommendations made at the conference should be published, and the federal Department of Environment should attempt follow-up action where appropriate.

As a result of the Panel's recommendation, the federal Departments of the Environment, Fisheries and Oceans, Indian Affairs and Northern Development, and Transport established the Environmental Advisory Committee on Newfoundland and Labrador Marine Transportation (EACNLMT) in October 1984. Representatives from the Government of Newfoundland and Labrador, the Canadian Petroleum Association, the Labrador Inuit Association and the Naskaupi-Montagnais Innu Association were invited to sit on the Committee. The Committee reported to the Director General, Canadian Coast Guard-Newfoundland Region and was charged with responsibilities:

- to provide a forum for consultation among government, native groups, industry and others on environmental and resource use activities relating to the management of shipping routes and ship movements within the waters surrounding Newfoundland and Labrador;

- to review marine shipping proposals, at the request of the Canadian Coast Guard, so as to determine potential implications for the environment and for natural resource users;

- to recommend preventative measures and guidelines for shipping routes and ship movement in the waters surrounding Newfoundland and Labrador which recognize environmental sensitivities, environment-shipping interactions, and natural resource uses, and which minimize the environmental risks;

- to identify environmental information gaps and make recommendations on areas of research which should be addressed by government and/or industry; and,

- to advise and consult with the Canadian Coast Guard-Newfoundland Region on all matters of mutual concern.

2.0 TANKER TRAFFIC AND RELATED ENVIRONMENTAL AND SOCIO-ECONOMIC ISSUES

The initial task of EACNLMT was to identify potential environmental and socio-economic issues associated with existing and proposed tanker traffic through the Labrador Sea and the Strait of Belle Isle. From official transcripts of the Beaufort Sea Assessment Panel public hearings held in Nain (Labrador), Resolute (Northwest Territories) and Ottawa (Ontario) in 1983 and from associated submissions by the Labrador Inuit Association (LIA), Inuit Tapirisat of Canada and the Government of Newfoundland and Labrador, EACNLMT was able to draft a preliminary list of issues. To obtain more inclusive local input, a survey of Labrador and Strait of Belle Isle coastal communities was conducted from which a number of additional issues were identified.

The issues which emerged principally related to: vessel traffic management systems; tanker movements; tanker specifications and safety concerns; the causes and effects of tanker damage; reporting and responding to oil spills; contingency planning; environmental protection legislation; the effects of existing tanker traffic; marine services; compensation for losses or damage incurred by oil spills; business and related opportunities; and provisions for public consultation.

EACNLMT co-ordinated preparation of issue responses by government, industry and public interest representatives. The responses reflect the state of knowledge on these issues as of 1987 and highlight areas where further attention and information are required. An information report based on this exercise was prepared in English and Inuktitut by EACNLMT for distribution to coastal residents of Labrador and Strait of Belle Isle.

Recommendation 1: Environmental and socio-economic issues associated with the shipment of oil and gas through the Labrador Sea and Strait of Belle Isle should be monitored with attention to the level of oil exploration and development activities. The information report should be updated accordingly, in English, Inuktitut, and French, and distributed to coastal residents with consideration to the use of other communication media (e.g. video, slide/tape show).

3.0 REVIEW OF MARINE SHIPPING ACTIVITIES

Between 1984-1987, EACNLMT monitored marine shipping for environmental concerns, identifying the type, frequency and routes of vessel traffic within the Labrador Sea and Strait of Belle Isle and the associated risks. Attention was primarily directed at oil shipments as an activity perceived to pose the greatest threat to the marine environment.

3.1 Large Tanker Traffic

3.1.1 Bent Horn

Given the extreme remoteness of those Arctic regions where oil and gas have been found, it is probable tankers will be used for transport to southern markets. As evidenced by the Bent Horn oil development project, oil and gas will likely be shipped from the Arctic through the Labrador Sea and Strait of Belle Isle as it is the shortest and most economical route to the eastern seaboard of Canada and the United States.

Panarctic Oils Ltd., a government-industry consortium involved in exploration and delivery of High Arctic oil, has shipped crude from its Bent Horn wells on Cameron Island to refineries in Montreal every summer since 1985. In 1987, Panarctic began making two shipments of crude annually. Information on the project and concerns pertinent to transport of oil south of 60° N were directed and addressed through EACNLMT.

The ice breaking tanker, M.V. Arctic, received the crude at Bent Horn and undertook the first 320 km (approx.) of the journey. In a zone of reduced ice hazard, near Rea Point, the cargo was transferred to the tanker, M.V. Imperial Bedford, which completed the voyage. The exact route of the M.V. Imperial Bedford within the Labrador Sea was influenced by winds, currents and ice conditions, but in general, was in excess of 100 km offshore until south of Groswater Bay where it traversed Hamilton Bank and Strait

of Belle Isle. EACNLMT monitored the status of the M.V. Imperial Bedford with regard to oil leaks and repairs through information provided by Environmental Protection of Environment Canada and Canadian Coast Guard (CCG) of Transport Canada.

While efforts to have an observer from the LIA placed on M.V. Imperial Bedford during its 1986 voyage were unsuccessful, because of cited logistical constraints, negotiations to allow an observer on future voyages were continued. It was generally agreed by the Committee that an LIA observer on the M.V. Imperial Bedford would serve to build confidence and improve dialogue between the oil industry and residents of the Labrador coast and Strait of Belle Isle.

Recommendation 2: **As appropriate, observers from public interest groups most affected by specific tanker proposals or tanker activity should be accommodated on large tankers navigating the Labrador Sea and Strait of Belle Isle to improve understanding and communication between the public and the oil and gas industry.**

3.1.2 Hibernia

A proposal to evaluate oil tanker traffic from Hibernia was deferred indefinitely given the Hibernia Environmental Assessment Panel recommendations for such shipping to be assessed by the Canada-Newfoundland Offshore Petroleum Board.

3.2 Coastal Fuel Resupply

EACNLMT identified and made initial assessment of the potential environmental risk posed by routine transport of fuel supplies to coastal Labrador. Anticipated increases in quantities of fuel delivered, as the result of expanded military activity at Goose Bay and installation of long and short range radar sites on the Labrador coast, were flagged as being of particular concern.

In its assessment, the Committee reviewed shipping activities along the Labrador coast between January 1981 and September 1985 through information acquired from the CCG Vessel Traffic Systems data bank. While its review was not completed, EACNLMT concluded that there is a significant concern and further investigation is warranted.

Recommendation 3: Routine resupply of fuel to locations on the Labrador coast should be re-evaluated. Potential impacts, associated environmental and socio-economic issues, and appropriate mitigative measures should be determined in consultation with the major resource users.

3.3 Other Shipping

The proposed 1985 voyage of the cruise ship M.V. World Discoverer was reviewed by EACNLMT for environmental concerns. After leaving Baffin Bay, the cruise vessel was scheduled to navigate the Labrador Sea and Strait of Belle Isle making stops at Saglek Bay, L'anse au Meadows and Gros Morne National Park. The 1986 voyage of the M.V. World Discoverer did not include any stops along the Labrador coast.

3.4 Vessel Traffic Management

3.4.1 Reporting Tanker Traffic

It was requested through EACNLMT that attention be directed at establishing a reporting system south of 60°N that would ensure fishermen and coastal residents are aware of the locations of tankers as they navigate the Labrador Sea and Strait of Belle Isle.

After a first experience in attempting to provide information on the movements of the M.V. Imperial Bedford south of 60°N in 1985, the LIA and CCG successfully arranged a reporting system that informed fishermen, and other resource users on the Labrador coast and Strait of Belle Isle, of the progress of M.V. Imperial Bedford during its second voyage in 1986. The CBC program "Fisherman's Broadcast" proved to be an especially effective means of communication in this regard.

Recommendation 4: A communications system which enables coastal residents and fishermen to be adequately informed of the progress of tankers through the Labrador Sea and Strait of Belle Isle should be maintained. Public broadcast of tanker movements on local radio has proven especially effective.

3.4.2 Telecommunications Network

EACNLMT reviewed CCG plans under its policy of telecommunications consolidation for potential impacts on local fishermen and shipping, particularly as it related to automation of the CCG Radio Station at Cartwright.

Concerns that effectiveness of the telecommunications network would be compromised by automation were addressed through the Committee in terms of possible implications for safety and for environmental and resource protection. As a result of the Committee's deliberations, arrangements were made to inform fishermen of forthcoming projects directed at improving network efficiency. The Committee also advised CCG to involve fishermen in assessing the adequacy of the network and in selecting new telecommunication receiver sites.

Recommendation 5: Fishermen and other major resource users on the coast of Labrador and the Strait of Belle Isle should be informed of and consulted on proposed changes to the CCG telecommunications network early in the planning stages and be involved in assessments of the network's adequacy and in selection of new telecommunication receiver sites. CCG should consult directly with fishermen on the coast of Labrador and Strait of Belle Isle when evaluating the effectiveness of any such changes.

4.0 POTENTIAL IMPACTS OF MARINE SHIPPING ACTIVITIES

The major potential impacts associated with shipping activities in the Labrador Sea and Strait of Belle Isle were examined by EACNLMT. It was determined that potential oil spills from, and the creation of leads and noise by, tankers constituted the principal impacts on the marine environment.

4.1 Oil Releases

4.1.1 Wildlife Resources and Harvest

Seabirds

Oil releases near breeding colonies, such as the Gannet or Herring Islands, in early summer could result in large numbers of birds being killed. Lower numbers might be affected in fall or spring when migratory birds are found along the coast.

Seabirds and seaducks are at risk to oiling because much of their time is spent on the water surface or in the water column. In late summer, flightless young and adults during moult are especially vulnerable.

Hunting seabirds is a traditional fall and winter activity that provides fresh meat. Labrador Inuit also hunt seabirds for food in the spring. Oil spills could kill enough seabirds that hunters would notice a decrease and shortages of traditional food may result.

Fisheries

Spilled oil reaching coastal areas along Labrador and within the Strait of Belle Isle could have some negative effects on local commercial and subsistence food sources such as capelin, blue mussels, clams, salmon, char, rock cod, and ringed seals. Weathered crude oil that reached the shore would have lost most of the lighter, more toxic fractions, and impacts would be largely physical such as smothering of capelin eggs, mussels, and other bottom-dwelling animals. Fresher crude, however, could cause direct poisoning. Planktonic and juvenile forms of various finfish and shellfish in the inshore area could be affected. Although local stocks could be reduced, it is unlikely a spill would be large enough to significantly affect species at the population level.

In general, resource losses could affect people who fish or hunt at a local level. Impacts would be short term, although they could be of moderate duration (one to five years) depending on such factors as: severity of the spill, time of year, toxicity of the crude and life history of the animals. Even if animals are not killed, possible tainting of finfish and shellfish could make catches unpalatable. Once a spill is stopped and the oil weathered, tainting should cease within days to weeks.

Spills on shelf break areas are of concern because of high levels of biological activity found there. Impacts upon plankton populations would be minimal because of the large size of such populations within the Labrador Sea. Impacts on larval fish and fish eggs at or near contaminated surface waters could be significant; for example, a large proportion of one year class of a fish species could be lost. Even if this was to occur, it is unlikely mortality of larvae would result in significant losses in additions to the commercial fishery 5 to 10 years later, as other environmental factors could compensate. However, the loss of species with a short life span, added to the fishery at an early age (3 to 4 years), could result in a reduced catch. The most vulnerable species in this regard would be shrimp and capelin.

Waters of the open Labrador Sea, defined as the area beyond the 2,000 metre contour, may not be particularly sensitive to oil spills. Therefore, incidents occurring here may have little impact on coastal residents or on offshore fishing interests.

Marine Mammals

Whales and adult seals tend to be less affected by oil contamination to their body surface than do birds and fish. In addition, their large body size, blubber insulation and large energy reserves allow them to avoid contaminated areas, even if this reduces food intake for a considerable period.

A critical time for seals is March through May when pups are born on pack ice as it moves southward along the Labrador coast, through the Strait of Belle Isle and into White Bay and Notre Dame Bay. Some deaths could result from exposure to oil immediately after birth, before pups are completely self-sufficient from their fat reserves. Seals are less susceptible once they begin predatory feeding.

4.1.2 Historic Resources

Many historical and archaeological sites in Newfoundland and Labrador are at, or are very close to, present sea level and may be at some risk from spills, especially if oil coming ashore coincided with high tides, onshore winds, storms or ice rafting. Artifacts, soils and structures within these sites could become contaminated and pollen, seed, bone and charcoal samples used for analysis and dating could be spoiled.

Underwater historic sites, specifically those located on the north shore of the Strait of Belle Isle, could be damaged by oil spills and subsequent clean-up operations. These waters contain a large number of shipwrecks, bone, collapsed shore stations and other artifacts.

4.2 Leads

Time required for leads to close is related to air temperature; and therefore, varies throughout the ice season. While recent Arctic research has indicated newly formed leads in landfast ice close or freeze over quickly with no adversity to local hunters, the experiences of Labrador hunters with ice breaking trials in Lake Melville demonstrated that leads can pose some difficulties. Problems were largely associated with a lack of communication as to the nature and timing of ship passage and ice breaking activities, and loss of access to trapping and hunting areas.

Concern that leads would attract and trap whales does not appear to have been confirmed in recent Arctic experience. As ringed seals whelp in ice dens there is potential for some seals to be crushed by tankers. However, given the low frequency of vessel trips, the small total area of the vessel track, and wide distribution and large population size of ringed seals, impact at even the local level should be insignificant.

4.3 Noise

Underwater noise levels created by large tankers would be between 130 and 180 decibels (dB) in a frequency range of 10 hertz (Hz) to 10 kilohertz (kHz). This level is close to that generated by other large vessels presently operating in the area and by drill ships when they were active in the Labrador Sea.

As lower frequencies in the noise spectrum propagate from a source, a 180 decibel source level at 10 hertz may not reach "normal" noise levels for 370 km. While there is concern low frequency noise may interfere with communication of whales within the zone of influence, there is no evidence of effects on marine mammals from noise at such distances.

Presence of increased tanker traffic could have an effect on large mammals such as seals and whales throughout the entire corridor of the Labrador Sea, although the nature or extent of any effect is unknown. The area, including Strait of Belle Isle, is an important feeding ground for several species of Blue, Fin, Humpback and Minke whales. This is also a major breeding area for harp and hooded seals, and several breeding and migration routes converge in Strait of Belle Isle.

Most birds move out of the way when ships approach and then resume their normal activities. It is not expected noise will affect seabirds to any great extent.

There is a general lack of knowledge regarding effects of noise on birds, fish, seals and whales, and the need to undertake some basic research was identified during the Arctic Pilot Project and Beaufort Sea Environmental Impact Assessments.

Recommendation 6: Existing vessel traffic in Arctic and east coast waters, and research findings, should be monitored for ongoing assessment of potential impacts on the marine environment with attention to the effects of oil releases and the creation of leads and noise during ice breaking activities. Existing mitigative measures should be implemented, and additional measures identified and knowledge acquired through research outlined in Section B.

5.0 CONTROL MECHANISMS

EACNLMT reviewed existing legislation and administrative measures directed at control of shipping activities north and south of 60°N latitude. Because of the higher level of protection offered by the Arctic Waters Pollution Prevention Act (AWPPA) north of 60°N, EACNLMT formed a subcommittee to explore options for enhancing the management and protection of the marine environment south of 60°N.

5.1 Current Legal and Administrative Regime

Marine traffic in Newfoundland and Labrador waters is principally controlled by CCG through application of the Canada Shipping Act and the Joint Industry - Coast Guard Guidelines for the Control of Oil Tankers and Bulk Chemical Carriers in Ice Control Zones of Eastern Canada.

The Eastern Canada Traffic Zone Regulations of the Canada Shipping Act apply within Canada's 19.3 km (12-mile) territorial waters and focus on the seaworthiness of vessels as it relates to potential threats to the environment.

Article 732 of the current Canada Shipping Act can be applied only when there is a clear threat to the environment from pollution but is applicable within Canada's 321.8 km (200 mile) economic zone subject to internal CCG administrative constraints.

The Joint Industry-Coast Guard Guidelines are voluntary. They include loading guidelines to minimize threats of pollution, delineating ice control zones, requirements for ships' officers to have ice experience and schedules for reporting ships' positions. In the past, when the Joint Industry/CCG Guidelines have failed to provide the level of protection desired by CCG, Article 732 of the Canada Shipping Act has been used to obtain the desired response from ships' operators.

5.2 Management Alternatives

Management alternatives identified by the subcommittee included extension of the Arctic Waters Pollution Prevention Act (AWPPA) south of 60°N, formalization of existing industry guidelines, coastal zone management and implementation of the Arctic Marine Conservation Strategy. Extension of the AWPPA, with its more stringent provisions for environmental protection, south of 60°N was generally viewed as the most preferable option. Accordingly, EACNLMT endorsed the broader definition of the Arctic as extending to the southern limits of landfast sea ice and of Inuit use and occupancy of Arctic waters, which was proposed by the LIA and adopted by the Department of Fisheries and Oceans (DFO) in their Arctic Marine Conservation Strategy.

However, in recognizing that political and jurisdictional constraints would effectively restrict extension of the AWPPA at present, the subcommittee examined alternate means of achieving a comparable level of environmental protection. Although there was considerable debate on the relative merits of the Arctic Marine Conservation Strategy, coastal zone management and the Joint

Industry - Coast Guidelines as potentially effective mechanisms for protection of the marine environment south of 60°N, consensuses on an implementation strategy and a plan of action in this regard were not attained.

Recommendation 7: The equalization of pollution protection measures applicable to marine waters north and south of 60 ° N through either extension of the Arctic Waters Pollution Prevention Act or implemention of comparable measures for marine water south of 60° N should be sought. In this regard, attention should be directed at enacting the Joint Industry-Coast Guard Guidelines for the Control of Oil Tankers and Bulk Chemical Carriers in Ice Control Zones of Eastern Canada as regulations and in supporting initiatives to implement coastal zone management and the Arctic Marine Conservation Strategy.

5.3 Canada Shipping Act Amendments

The LIA tabled with EACNLMT its presentation to the Senate Committee on amendments to the Canada Shipping Act (Bill C-75). However, a proposed assessment of provisions for pollution control contained within Bill C-75 was not completed by the Committee.

5.4 Contingency Planning

EACNLMT reviewed contingency plans currently in place for the Labrador Sea and Strait of Belle Isle.

Canadian Coast Guard has three contingency plans and one agreement that apply to this area. The National Marine Emergency Plan is the umbrella plan which outlines the organizational structure and line of responsibility that would apply during a major incident while the Newfoundland Region Contingency Plan details the regional operational structure. If a tanker or cargo was owned by one of the signatories to the Joint Oil Spill Response Plan (JOSREP), response procedures would be instituted in a joint industry-government operation.

There is also an agreement between the Governments of Canada and Denmark which outlines procedures to be followed if oil is spilled on either side of a demarcation line between Greenland and Canada.

Recommendation 8: **All contingency plans should be integrated with existing individual company and industry countermeasures and expanded where necessary. Oil companies and government agencies should also co-operate to ensure compatibility with government contingency plans and to ensure roles and responsibilities are well defined.**

Recommendation 9: **Contingency planning for any tanker traffic south of 60° N should be encouraged and developed in consultation with the major resource users on the coast.**

Recommendation 10: **Given the relative remoteness of any spill off the Labrador coast and the Strait of Belle Isle and the need for trained personnel to assist in clean-up operations, an inshore oil spill clean-up course should be offered in the major communities of coastal Labrador and the Strait of Belle Isle.**

6.0 ENVIRONMENTAL INFORMATION REQUIREMENTS

Through examination of the potential effects of marine vessel traffic, associated environmental and socio-economic issues, and existing studies concerning east coast waters, EACNLMT was able to identify and priorize research requirements where a lack of information and data presently restrict the capability to predict and mitigate potential environmental impacts.

Each research need was developed by the Committee into a 1-2 page summary which includes a rationale for proposed research and an outline of proposed timetables.

Independent of the research identification and priorization exercise, the Committee undertook a technical review of an unsolicited proposal entitled, "Response of Ocean Currents in Hopedale Saddle Labrador to the Passage of Low Pressure Systems" from Oceans Ltd. (Nfld) of St. John's. While supporting the project on its scientific merits, it was generally agreed that it would require further assessment in the context of other research needs associated with management of tanker traffic.

Recommendation 11: **Research needs should be implemented as described by EACNLMT in Section B.**

7.0 CONCLUSION

EACNLMT met on seven occasions within the province between 1984 and 1989 and provided a forum for the public, industry, and provincial and federal governments to discuss their concerns and exchange information related to shipping activities in the Labrador Sea and Strait of Belle Isle.

Public involvement was achieved through membership of the LIA, the open meeting held in Goose Bay which was attended by representatives from Mud Lake and Port Hope Simpson community councils, an open invitation to the Joint Councils of Labrador to participate in future meetings, and the issues survey of coastal Labrador and Strait of Belle Isle residents. The Naskaupi-Montagnais Innu Association did not respond to the Committee's invitation.

The Canadian Petroleum Association and the Arctic Petroleum Operators Association collectively represented the interests of the oil and gas industry.

EACNLMT also successfully collaborated with its counterpart north of 60°N, the Environmental Advisory Committee for Arctic Marine Transportation (EACAMT), with designated representatives on each Committee having dual membership.

To enhance its understanding of certain issues, the Committee invited spokespersons for various interests to address its members during meetings. Industry representatives outlined specifics regarding the Bent Horn project and plans for the transport of oil and gas through east coast waters with attention to tanker design and routes and anticipated impacts. CCG representatives described their plans for upgrading and consolidating the telecommunications network and presentations on ice information capabilities and the potential impacts of oil and marine traffic on the seabird resource were made by Environment Canada personnel.

Through its deliberations, the Committee was able to successfully address its most important tasks of: identifying environmental and socio-economic issues associated with shipping oil and gas through the Labrador Sea and Strait of Belle Isle; reviewing shipping activities south of 60°N and highlighting potential impacts associated with this vessel traffic; examining the legal and administrative regime for marine waters north and south of 60°N; and, identifying and priorizing research needs.

The mandate of EACNLMT expired with consolidation of the various consultative groups, which have been formed throughout the country, into an organization called the Canadian Coast Guard Marine Advisory Council. It is the stated intention of CCG that regional Committees of the Advisory Council will operate under a broadened mandate providing advice on all aspects of Coast Guard services.

SECTION B: RESEARCH NEEDS AND PRIORITIES

PRIORITY I (PI) RESEARCH: Physical Characteristics of the Marine Environment and Resource Issues

Physical research is considered to be a first priority because it is a prerequisite to collection of more specific biological baseline data and assessment of oil spill clean-up technology relative to the Labrador Sea and Strait of Belle Isle. Priority I research tasks were identified as follows:

(a) Update of Coastal Hydrographic Charts for Labrador (B-2).

(b) Assessment of Physical Oceanography (B-3).

(c) Identification of Potential Tanker Ports of Refuge on the Labrador Coast and Strait of Belle Isle (B-5).

(d) Development of a Rational Ice Classification System for the Labrador Sea (B-6).

(e) Enhancement of Ice Information and Services (B-8).

Study of resource use and conflict issues should be undertaken concurrently with physical research as follows:

(f) Inventory and Documentation of Resource Use Patterns and Values (B-12).

(g) Assessment of Existing Information on Coastal Historic Resources and Documentation of Deficiencies (B-16).

(h) Study of Effects of Existing Tanker Traffic on Renewable Resources and Their Utilization (B-19).

PI (a) Update of Coastal Hydrographic Charts for Labrador

The present status of surveys on the Labrador coast reveals that only 15% meet modern standards.

To upgrade all charts to modern standards for the entire coast would be an enormous task. The two basic requirements prior to the commencement of the actual survey are: the establishment of both horizontal and vertical control; and the acquisition of good photogrammetric shoreline plots. The logical approach for the survey itself would be to use the new LARSEN 500 system. This is an airborne system using laser measuring techniques, which provides rapid coverage (e.g. 50 km^2/hour) and is capable of measuring depths to 30 meters. For the entire Labrador coast, the first three steps (i.e. horizontal and vertical control; good photogrammetric plots; and LARSEN surveys) would take several years and cost several million dollars. As stated above, this would only delineate the hazards to a depth of 30 meters. Beyond the 30-meter depth conventional surveys would be required which is a costly and time consuming project; it is estimated that it would take a large survey vessel 15 seasons (four months per season) to complete these surveys of the Labrador coast, which translates into $30M (1986 dollars) based on current ship costs of 20K/day. The above does not address charting (i.e. compiling and drafting the actual charts under contract) costs, which would amount to a further $820K.

An alternative to the above proposal would be to survey and chart several refuge harbors between Nain and Cape Chidley (the charts south of this provide adequate coverage for communities and refuge harbors). The specific areas should include Nain, Okak Bay, Napaktok Bay, Nachvak Fiord, Ryans Bay, Eclipse Channel, Saglarsuk Bay, Ekortiarsuk Fiord and Joksut Inlet. As per the first proposal, this would involve the establishment of horizontal and vertical control and the acquisition of good photogrammetric plots before the actual survey could commence, the estimated cost of which would amount to $500K. The actual hydrographic sounding would likely take a major ship such as BAFFIN three seasons (four months per season) to complete, for a further cost of approximately 7.5M. Charting would involve eight new charts at an estimated contract cost of 20K/chart for a total of $160K.

PI (b) Assessment of Physical Oceanography

Recent physical oceanographic work in the Labrador Shelf - Belle Isle Strait area has included:

i) A current meter program on Hamilton Bank (Lazier);

ii) Arrays of current meters and pressure gauges from Nain Bank to the Northeast Newfoundland Shelf (Lazier, Wright, Symonds and Thompson);

iii) Petro-Canada program on the Labrador Shelf;

iv) Offshore Labrador Baseline Studies (OLABS) program ;

v) Petro-Canada - AOL (Atlantic Oceanographic Laboratory, Bedford Institute of Oceanography) program on the Northeast Newfoundland Shelf; and,

vi) The AOL-Dalhousie University program in the Strait of Belle Isle.

In addition to these observational programs, there has been of a considerable modelling effort in the region including:

i) Current modelling (Webster and Narayanan - Memorial University);

ii) Barotropic modelling of (Royer, Wright, Greenberg and Petrie - AOL);

iii) Baroclinic and tidal modelling (Greenberg);

iv) Strait of Belle Isle modelling (Toulany, Petrie and Garrett);

v) Baroclinic and ice modelling (Ikeda and Symonds).

The amount of data from this area is extensive. In addition to the above, there are hydrographic, wave climate and ice climate data products available. The task is to synthesize this information into a format appropriate to the issue of tanker traffic and the fate/behavior of spilled oil.

There would appear to be two weak points in the existing data base for this region. These are the wave climate and the surface properties revealed by infrared imagery. While satellite images for the area, have been processed (Symonds and Ikeda - AOL), the focus has been on ice distribution. A study of the imagery, with the emphasis on the fronts and current routes deserves consideration.

The recommended research approach is to prepare a review of the extensive observational and modelling work completed and underway, producing at least a series of maps including:

i) a map of mean currents;

ii) a map of tidal currents (ellipses, perhaps);

iii) a map of low frequency variability; and,

iv) a map of the ratio of i) to iii), which will indicate how well short term prediction might do.

This review should identify, and suggest guidelines for, studies that need to be undertaken, if any, to supplement existing knowledge and data for express purposes relevant to oil trafficking. New observational programs or modelling studies should not be undertaken before existing knowledge of the Labrador Sea - Strait of Belle Isle region is appraised.

PI (c) Identification of Potential Tanker Ports of Refuge for the Labrador Coast and Strait of Belle Isle

For potential tanker ports of refuge to be identified, it will be necessary to document (describe and map) biological, physical and socio-economic resources of the Labrador coast and Strait of Belle Isle. The results will also aid in making appropriate shore zone management decisions for this region.

The specific objectives of the project would be to:

1. Review and update the existing biological, physical and socio-economic data sources relevant to the Labrador coast and Strait of Belle Isle.

2. Conduct cruises of the study area focusing the field effort on those specific areas identified by CCG as logistically feasible for use as tanker ports of refuge.

3. Evaluate and summarize the information collected with respect to the identification of:

   a) coastal geomorphology;
   b) marine and freshwater fish;
   c) seabirds, waterfowl and raptors;
   d) marine mammals;
   e) characteristic intertidal and subtidal habitats (flora and fauna) including major sediment types;
   f) location and description of all commercial fisheries;
   g) location and description of biologically sensitive areas within the study area;
   h) location and description of relevant socio-economic factors (settlements, fish plants, fisheries and other resource use); and,
   i) relevant physical environmental parameters.

4. Construct inventory maps (biological, physical and socio-economic) at a scale of 1:50,000 for those areas identified as potential tanker ports of refuge.

5. Construct a more general coastal map (scale of 1:250,000) of the Labrador coast and Strait of Belle Isle showing major physical and biological features.

6. Prepare a final report that will describe and comment on the above information and will point out seasonal variations of all factors mentioned.

PI (d) Development of a Rational Ice Classification System for the Labrador Sea

In recognizing the extreme harshness of the northern Labrador Sea physical environment, the vulnerability of the biological resources of social and economic value, and the severe limitations imposed on mitigating measures, special shipping control measures may be required in order to minimize the probability of a major pollution incident occurring with its concomitant risk to the biological and socio-economic environment. The option of enacting the Joint Industry-Coast Guard Guidelines for the Control of Oil Tankers and Bulk Chemical Carriers in Ice Control Zones of Eastern Canada (JIG) as regulations should be investigated. A rational ice classification system for the Labrador Sea is a prerequisite for such a system. Thus, control of shipping could be more closely aligned with that which is in effect north of 60° (i.e. the use of some form of snipping safety control zones, standardized ice classification of vessels, use of pollution prevention officers, etc.)

The need is supported by a perception that control mechanisms are more definitive and protective north of latitude 60°N than south of 60°N, reinforced by the Labrador Inuit Association's presentation to the Legislative committee dealing with Bill C-75.

The notion of ice control zones - or shipping safety control zones - as a component of a regulatory JIG in waters of the Labrador Sea to the extent of the 321.8 km (200 mile) economic zone should be examined with attention to:

- regulatory and sovereignty implications;
- the dynamics of ice conditions;
- ice navigation;

- marine risk and casualty probability; and,

- socio/economic and biological impact of marine accidents.

A rational ice classification system by which to control the navigation of Tankers and Chemical Carriers should be formulated accordingly by:

- categorization of zones;

- time periods; and,

- construction, design, equipment, navigational, pilotage, and other standards.

Funding should be sought from Canadian Coast Guard and Environment Canada. This initiative should be led by Canadian Coast Guard with support from Environment Canada.

PI (e) Enhancement of Ice Information and Services

Description of Ice Climatology

In 1988 Ice Branch of the Atmospheric Environment Service completed a third Ice Atlas for Canadian Waters. This atlas contained all the area of concern as well as Hudson Strait and Hudson Bay.

In addition to this new atlas, preparatory work is underway to update the existing numerical database for the more south eastern Newfoundland waters with plans to produce an updated Ice Atlas for the Eastern Canadian Seaboard. Ice parameters for both atlases will include only sea ice in terms of the amount of ice present on a weekly basis on a 30 n. mi. grid for the following sea ice classifications:

- new ice
- grey ice
- grey white ice
- first year ice
- second year and multi-year ice (old ice)
- floe sizes 100 m or greater

With respect to iceberg information, the International Ice Patrol data is being plotted on charts and analyzed on a monthly basis to produce in-house reference material on the observed frequency of occurrence of icebergs over the east Newfoundland waters and approaches to the Strait of Belle Isle area.

Since this database is felt to be sufficiently representative to delineate the outer limits of the extent of icebergs, the feasibility of a publication of this type is being investigated. It is not felt that this database sufficiently represents area and more northern iceberg distributions, however, due to historical data collection programs not specifically designed to produce these types of climatological outputs. Before regional iceberg climatologies can be developed, appropriate data collection programs should be established. The AES Iceberg Analysis and Prediction System (IAPS) has the computer processing power and facility to accomplish this provided a consistent long term data collection program can be maintained. In view of recent program adjustments, such data collection programs are vulnerable to budget cuts due to their high costs and non-immediate impacts.

In terms of site-specific iceberg motions, considerable data has been gathered along Canada's Eastern Seaboard during the past 15 years. Most of this data has been transferred to COGLA as part of end-of-well reports, and in due course is transferred to Ice Branch, AES, for archiving. Iceberg distribution densities and fluxes on a regional basis, however, cannot be determined from

these data sets. As a result, accurate predictions of probability of impact with icebergs cannot be made using these data sets. Their main application is in the fields of iceberg drift modelling and engineering.

In terms of other data sets which can be created from existing raw data, the AES and private industry SLAR/SAR imagery could be reanalyzed along latitude lines across the Labrador Sea Ice Pack to more completely describe sea ice floe sizes and their distributions. Similarly, ice floe motion in terms of weekly and monthly mean velocities and trajectories for the larger ice floes can be determined through analysis and digitization of satellite imagery. The Institute of Ocean Sciences in British Columbia has this capability and should be supported to continue this work.

With respect to other sea ice and iceberg parameters, there is a general consensus among the user community that deficiencies also exist in the areas of:

- offshore ice thickness values
- ice strength
- ice pressure

Ice Descriptive Systems

This category could be divided into three sub topics:

i) Observational and remote sensing data collection systems

Ice Branch has a plan of operational iceberg observation and data collection as well as continued development in the field of remote sensing. For example:

- Laser profilometer, digital and automated
- Passive microwave radiometer, airborne R&D
- Ice thickness remote sensor, prototype investigations
- SLAR applications

Since each remote sensor describes ice differently, it is not always possible to convert such information into conventional terms familiar to the user. Frontier technological development of this type tends to graduate from prototype-experimental to production-operational without a clearly defined point of conversion. As a result, both the user and new data applications tend to develop new concepts which may or may not become accepted standards until several years later.

ii) Numerical and symbolic coding of ice types and other ice parameters

Generally this is a result of the need to communicate and transfer information to meet user applications. Although this follows logically from the natural progression of the sub topic just described, it is also a function of newly generated products, display systems and communications. The proposed expansion of AES ice services to include iceberg information will without doubt initiate change in all these areas.

iii) Information systems

In this respect, there is a definite technological trend toward digital representation of all types of data to take advantage of the powers of numerical processing. The new generation of AES computerized information systems are being designed to permit user access to database catalogues, software packages, specialized products and raw data. The following is a list of planned AES ice information systems all to be on stream by 1990.

Iceberg Analysis and Prediction System (IAPS)
Ice Centre Communications System (ICCS)
Ice Data Image Analysis System (IDIAS)
Climatological Research Ice Statistical Package (CRISP)
Climatological Ice Data Archiving System (CIDAS)

The numerical database on which the new atlas for the Labrador waters and approaches to Hudson Bay is based will be converted to the international SIGRID format and installed on the AES computer system in Downsview as part of ongoing efforts to increase our departmental readiness to meet offshore resource and transportation development requirements. The CRISP system presently operates on several atlas databases including that for the Eastern Canadian Seaboard.

Key items to be addressed at this point in time are those of mass data transfers and storage - particularly, that of digital imagery from airborne and spaceborne radar surveillance system (SLAR/SAR/RADARSAT). It seems clear that the user and R&D community must have access to raw full resolution data for a reasonable length of time. It also seems clear that hard-copy technology will have to be maintained to some degree in the foreseeable future.

Ice Forecasting

In terms of operational capability, a plateau had been reached in the mid-seventies. The volume and variety of incoming data had reached the point where manual methodology could not handle all that was available. Since then, digitizing and numerical processing techniques have been slowly emerging to automate and integrate various functions. Within a very few years most of the ice data inputs and outputs will approach complete automation and integration. The expected result, therefore, is that development of numerical predictive modelling will accelerate quickly to the point where new and additional complimentary data sets will be again required. For instance, without operational oceanographic circulation patterns, ice floe motion prediction will be severely limited. Overall product quality and suitability to application, however, should markedly improve.

PI (f) **Inventory and Documentation of Resource Use Patterns and Values**

The following list and other relevant sources should be reviewed to determine the extent of information available on resource use patterns for people living on the coast of Labrador and to identify information gaps which may be the subject for further research.

Selected References on Resource Use Patterns from:

"Socio Economic Development in Labrador - A Select Bibliography" Department of Rural Agricultural and Northern Development, 1985.

Fisheries

ATLANTIC BIOLOGICAL SERVICES LTD. The Labrador Fisheries: A Review by Margaret R. Sandeman and Robert A Buchanan. St. John's: Atlantic Biological Services Ltd. 1980. Provides a general overview of the Labrador Fishery based on 300 published and unpublished works as well as personal interviews with government officials, plant operators and fishermen. The main emphasis is on the biological aspects of the fishery but the report does address socio-economic and fisheries management issues as well. (Fed. Fish. Library).

BOLES, B. Jackson, L. Makey, M. Breaking The Ice: Seal and Seal Harvesting Patterns and Benefits in Relation to Navigational Ice Breaking in Lake Melville, Labrador. Goose Bay. Labrador Institute of Northern Studies, (LINS) 1983.

BROTHERS, G. AND SCOTT, W.B. Fishery Development: Northern Labrador 1974. St. John's: Environment Canada, Fisheries and Marine Service, Industrial Development Branch, 1974 (LINS).

CANADA. Commercial Explorations for Shrimp and Turbot, Labrador. St. John's: Fisheries and Marine Service, Environment Canada, 1976 (LINS).

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VERNON, G.C. Presentation of a Discussion Paper by Fisheries Council of Canada.

CASHIN, R. Presentation on the Utilization of Northern Cod.

DOUCET, F.J. Presentation on the Utilization of Northern Cod.

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CANNING, S. The Hamilton Banks Cod Fishery: A comment on the Politics of Balanced Development. St. John's: MUN Centre for the Development of Community Initiatives. 1977 (LINS).

COADY, L. The Arctic Char Fishery of Northern Labrador. St. John's: Department of the Environment, Resource Development Branch, Fisheries and Marine Services 1974 (LINS).

GOVERNMENT OF NEWFOUNDLAND AND LABRADOR. Labrador Fisheries Statistics. St. John's: Economic Branch, Department of Environment, Government of Newfoundland and Labrador, 1970-1975 (MUN).

JACKSON, E.T. Community Economic Self-Help and Small Scale Fisheries. Ottawa: Fisheries Economic Development and Marketing Service, Department of Fisheries and Oceans. 1983 (RAND).

LABRADOR RESOURCES ADVISORY COUNCIL (LRAC). Fisheries Conference Held in Happy Valley/Goose Bay, Labrador, Feb. 22-24, 1982. Happy Valley/Goose Bay: LRAC. 1982. (LINS).

MORRIS, G., MONTAGUE, L. and FLOWERS, W. Proposal to Federal Department of Fisheries and Environment Respecting the Need to Establish an Open and Closed Season on the Taking of Jar Seals in Lake Melville, Labrador. Goose Bay: LRAC (LINS).

MUN EXTENSION. Labrador Fisheries Conference held in Happy Valley on April 15-16, 1978. St. John's: MUN Extension Services, 1978 (LINS).

MUN EXTENSION. Labrador Fisheries Conference held in Happy Valley on April 24-25, 1976. St. John's: MUN Extension Service, 1976, (LINS).

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Planning, Social and Economic Development

HOUSE, J.D. Big Oil and Small Communities in Coastal Labrador: The Local Dynamics of Underdevelopment.

MUN. Symposium on Research in the Labrador Coastal and Offshore Region Held in St. John's on May 8-10, 1979. St. John's: MUN. 1979 (LINS). Symposium Proceedings Included the Following:

NORTHCOTT, T. Resource Utilization and Potential Impacts.

HANLEY, P., HENNIGH, G. AND GRAHAM, K. The Impact of Resource Development on Small Communities.

SAUNDERS, D. Community Concerns with Oil and Gas Exploration in Labrador

HOUSE, D. Local People and Transnational Technology.

WILLIAMSON, H.A. A Preliminary Summary: Social and Economic Conditions on the Labrador Coast. Goose Bay: MUN, Labrador Institute of Northern Studies. 1980 (LINS).

PI (g) Assessment of Existing Information on Coastal Historic Resources and Documentation Of Deficiencies

The following list and other relevant sources should be reviewed to determine the extent of information available on coastal historic resources and determine information gaps which may be the subject for further research.

Approximately 1500 coastal sites are currently known and some areas have been intensively surveyed, however the present state of knowledge is in no way considered complete. Archaeological sites tend to be miniscule in relation to the thousands of kilometres of coastal bays, coves, headlands and river mouths, and terraces marking former strand lines. It is likely, therefore, that many times the current number of sites exist. The attached list should not be regarded as complete, definitive, or suggesting that no other sites exist in these areas.

Regions which have been only cursorily examined by archaeologists include the coast from Cape St. Charles to Hamilton Inlet's south shore, the outer exposed islands along the entire Labrador coast, the area between Smokey and Makkovik, Belle Isle, and coastal areas between the major bay/fjord complexes at Okak, Hebro, Saglek, Ramah, Nachvak, Seven Islands Bay, and from there north to Cape Chidley.

NOTE: All references are on file at the Newfoundland Museum, St. John's

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1987 1986 Archaeological Survey of Southern Labrador: Quebec/Labrador border to Cape St. Charles. Report on file at the Newfoundland Museum, St. John's.

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1972 Environmental archeology and cultural systems in Hamilton Inlet, Labrador. Smithsonian contributions to Anthropology 16.

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1978a Maritime Archaic cultures of the central and northern Labrador coast. Arctic Anthropology 15(2):61-97.

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1980 Preliminary report on the Torngat Archaeological Project. Arctic 33(3):585-606.

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Jordan, Richard
1980 Preliminary results from archaeological investigations on Avayalik Island, extreme northern Labrador. Arctic 33(3):607-627.

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1980 Neo-Eskimo occupations of the northern Labrador coast. Arctic 33(3):646-659.

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1983 Economic and Social change in Labrador Neo-Eskimo culture. Ph.D. dissertation, Department of Anthropology, Bryn Mawr College.

Lazenby, Colleen
1980 Prehistoric sources of chert in northern Labrador: field work and preliminary analyses. Arctic 33(3):628-645.

McGhee, Robert and James Tuck
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Nagle, Christopher
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Renouf, Priscilla
1977 A late Paleo-Indian and early Archaic sequence in southern Labrador. Man in the Northeast 13:35-44.

Tuck, James
1975 Prehistory of Saglek Bay, Labrador. Archaeological Survey of Canada Mercury Series 32.

Sproull Thomson, Jane and Callum Thomson (eds.)
1981-1987 (in print) Reports by:

Thomson (1981, 1982, 1983, 1984, 1986, 1987)
Fitzhugh (1981, 1982, 1984, 1985, 1986)
Kaplan (1985)
Tuck (1981-1987)
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Sutton (1981)
Hood (1981)
Parks Canada (1982-6)
Pastore and Auger (1984)
Keenleyside (1985)
Nagle (1985)
Vera (1986)
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PI (h) Study of Effects of Existing Tanker Traffic on Renewable Resources and Their Utilization

The discussion of the effects of existing tanker traffic on the Labrador coast must consider two areas, the Strait of Belle Isle and the Northern coast. The seasonality of the shipping season must also be considered since traffic along the coast and in the Straits is generally restricted to the ice-free season of May to November for most areas.

The Strait of Belle Isle provides a major shipping route for international traffic during the open water season. In excess of 1000 vessels move through the Strait each year and a portion of the vessels are oil tankers either bound for the Gulf of St. Lawrence or the North Atlantic and Arctic. There has been no major incident, in recent years, involving any of these vessels. No major oil spills nor groundings have been reported nor have there been any significant complaints from fishermen in the area of the interference by vessels with fishing activity.

Existing tanker traffic along coastal Labrador is not without incident. Although tanker traffic is limited to the open water season, icebergs are still present and pose a potential hazard but no iceberg collisions have been reported. Navigation along the coast is much more hazardous than through the Strait and the grounding of vessels on shoals is always a potential hazard. In 1984 a tanker inbound to Goose Bay ran aground after loosing steerage on the approaches to Rigolet. Some oil was lost but the quick response of the Canadian Coast Guard avoided a major spill. Numerous incidents occur each year when tankers are disconnecting floating lines to shore tanks during refilling operations. The volumes spilled during these incidents are relatively small, usually less than 100 bbls. The fuel spilled is volatile, either Arctic diesel or gasoline, and the rapid evaporation, dispersion provided by wave action negates the need for cleanup operations. These incidents do not pose significant hazards to harvesting of renewable resources.

A review of the past 5-10 years of reported tanker spills and a survey of the coastal residents for their perspective of potential problems would be sufficient to define future potential problems.

PRIORITY II (PII) RESEARCH: Biophysical Characteristics and Sensitivities of the Marine Environment

Initiatives to enhance knowledge of the biophysical environment and inherent sensitivies would be a second priority, requiring physical baseline data to better focus research. This research would also be driven by the level and location of resource uses, in particular as it relates to hydrocarbon exploration, production and transportation.

Priority II research topics would include:

(a) Review and Synthesis of Existing Information on the Acute and Sublethal Effects of Petroleum Hydrocarbons on Biota and the Applicability to Labrador Shelf Species (B-21).

(b) Examination of the Distribution of Northern (NAFO Division 2J3KL) Cod Eggs and Larvae (B-23).

(c) Assessment of the Effects of Oil on Harp/Hooded Seals (B-24).

PII (a) Review and Synthesis of Existing Information on the Acute and Sublethal Effects of Petroleum Hydrocarbons on Biota and the Applicability to Labrador Shelf Species

There currently exists voluminous literature on the acute and sublethal effects of petroleum hydrocarbons on marine biota. While only a fraction of this literature deals with species found throughout the Northwest Atlantic generally and the Labrador Shelf specifically, much of our accumulated knowledge of effects upon related species is applicable to local species of concern.

A statement of current knowledge is required to set the scene regarding further research effort. This requires an exhaustive and balanced review of the primary and secondary (i.e. gray) literature to produce definitive statements for each of the important seabird, marine mammal, finfish, and shellfish species important to local Labrador residents in a subsistence (i.e. country food), commercial, and recreational way.

The review will access all pertinent information available on these selected species and supplement this knowledge with information from closely related species from similar environments and ecosystems.

For each local species identified, a state-of-knowledge precis will be produced and included will be an indication of critical deficiencies, if any, in that knowledge.

Sublethal Effects Upon Fish

Considerable research has been carried out documenting the acute and to a certain extent, the short-term sub-acute effects of oil on arctic and sub-arctic organisms. This has included studies on fish, molluscs, crustaceans, plankton and ice (epontic) algae. Overall effects on arctic/sub-arctic species have been shown to be similar to effects noted in studies on similar species from other regions - in essence, northern species display no special sensitivity or resistance to oil toxicity.

The topic of sublethal effects is much more difficult to assess since studies are generally lacking. Chronic toxicity studies are both difficult and expensive and require wide expertise in various aspects of toxicology for interpretation. Therefore, it is unreasonable to expect that great numbers and varieties of animals or plants should be subjected to comprehensive sublethal effects testing. However, for instance, if questions concerning information on "proven" safe levels of hydrocarbons for fish are to be answered, sublethal effects studies will have to be carried out. With the exception of a few studies, by DFO, St. John's, on fish (and in the UK on bivalves), there is little information available on dose-response relationships for petroleum hydrocarbons. Thus, in order to provide a greater degree of confidence in risk-assessment studies, it is imperative to have at least some "hard" information on "proven" safe/unsafe levels of hydrocarbons for marine biota.

In relation to concerns related to effects on fish in the Davis Strait/Labrador Sea area, dose-response sub-chronic toxicity studies should be carried out on the effects of contaminated sediments on Greenland halibut. This would complement studies on codfish (relevant for Arctic and polar cod) and the recently funded PERD studies on salmon (relevant for Arctic char). Such information (in the case of Greenland halibut) on a deep water, commercially important flatfish species, will be of critical importance for either supporting or discounting concerns related to possible effects of hydrocarbons on a major fish stock in the area.

PII (b) Examination of the Distribution of Northern (NAFO Divisions 2J3KL) Cod Eggs and Larvae

The only information on Labrador cod egg and larvae distributions is from USSR investigations in the 1960's. Spawning concentrations are fished heavily by the international fleet, in the 300-500 meters deep water seaward of the 2J3KL fishing banks. Some information on spawning times exists from the Canadian surveys. This information needs to be consolidated and existing knowledge clarified. However, insufficient precision will result, such that it will not be possible to pinpoint the oceanographic phenomena that cod fish home to and spawn in. The drift of spawning products is apparently a matter of several weeks in cold water, and may involve 500-700 km of drift. This can really only be examined within a computer model of flow from Makkovik Bank to the Grand Bank. Such a modelling study is required before hypotheses about homing sites and drift patterns can be tested efficiently using research vessels, plankton nets, and in-situ egg counters. Such a study might have valuable stock management applications as well, since variability in the drift patterns could be predicted from model studies and related to recruitment success.

PII (c) Assessment of the Effects of Oil on Harp/Hooded Seals

Effect of Hydrocarbon Fumes on Seals

At certain times of the year, such as during the congregation associated with whelping, small portions of harp or hooded seal populations could be subjected to oiling. Although insufficient evidence is available to rigorously address dose-response relationships, laboratory studies indicate that fairly heavy oiling will be required to have deleterious effects on pinnipeds. Overall, it would seem that newborn pups, which have little thermoregulatory ability, will be much more sensitive to oiling. Consequently, it would be useful to have information on the level of oiling required to produce harmful effects on harp and hooded seal pups, but it is likely that no amount of oiling, harmful or otherwise, will presently be "acceptable". Also in relation to real biological impacts, it would seem that under most circumstances only very small numbers of animals will be coated resulting in population disturbances of little or no consequence.

However, given the right conditions, it is hypothesized that a far greater hazard to harp and hooded seal pups could be the toxic fumes associated with large oil spills. Unlike coating, which is expected to be a hit and miss phenomenon in ice leads, fumes could be more pervasive covering not only the fringes but the whole area of ice floes for several days. As noted by Engelhardt (1986) tests on rats, cats and dogs demonstrated that high levels of vapors can be fatal after several minutes of exposure, progressing from loss of coordination to convulsions and death. It is also likely that eye effects such as the conjunctivitis and corneal erosions noted in oiled seals, could be exacerbated by exposure over several days to toxic fumes. As well as having a direct effect on adults and pups, it is also likely that maternal behavior could be seriously altered, impairing rearing. Due to the seemingly real possibility for population level impacts, it is recommended that studies be carried out on the effects of hydrocarbon vapors on harp seal pups. The information obtained could be easily modeled to ascertain any risks associated with different size spills under different wind conditions. The idea would be to expose animals to harmful but, to the degree attainable, recovery-level concentrations of vapors with extrapolations made accordingly. (It is recognized that the lethality endpoint would have optimum scientific rigor, but lethality experiments, however important for risk analysis, will likely be found objectionable.)

It is also important to stress that the information obtained in experiments with harp seal pups will be generally applicable for assessing effects on seals in water - should large numbers be trapped in areas having high air concentrations of toxic fumes. Procurement of such information on the effects of fumes could be especially useful in the preparation of guidelines for tanker routing.

Level of Hydrocarbons in Seals

There is a need to carry out a comprehensive survey on the levels of hydrocarbons, and specifically polycyclic aromatic hydrocarbons in seals in the Davis Strait/Labrador Sea area. Recent observations on high levels of hydrocarbons in the blubber of seals in the Beaufort Sea highlight the importance of obtaining baseline data for seal populations. There is a good possibility that the blubber of seals is a good concentrator/integrator of hydrocarbons and could be an important index for trend monitoring studies. Different pinnipeds possibly integrate hydrocarbon pollution conditions in different environments, e.g. harp and hooded seals feed on different species over wide areas of the "open sea", ringed seals feed on different species inshore and bearded seals principally feed on benthic invertebrates in shallow waters. Initially, information should be obtained on as many species as possible including ringed, bearded, harbor, grey, harp and hooded seals with the option that a species such as harp or ringed would be more appropriate for regular trend monitoring.

It is important to obtain baseline data on seal populations and embark on long-term trend monitoring studies in order to address any of a number of real or perceived concerns that may arise in relation to harmful biological effects, contamination by PAH, tainting, etc.

PRIORITY III (PIII) RESEARCH: Oil Spills and Countermeasures in the Marine Environment

Third priority research would consist of generic issues that government, in particular Environment Canada, and industry have flagged as requiring attention, and will likely receive research and development funding when the level of offshore oil exploration and production increases.

Priority research III areas would include:

(a) Research and Development of Open Ocean Containment and Cleanup Technology (B-27).

(b) Determination of the Fate and Behaviour of Oil in Pack Ice (B-29).

(c) Tracking of Oil in Pack Ice (B-30).

PIII (a) Research and Development for Open Ocean Containment and Cleanup Technology

The preferred method of handling an oil spill is to remove the pollutant from the sensitive environment. To this end, research and development has been directed toward containment and recovery. Nevertheless, no system has yet been developed which operates efficiently in the offshore in high sea states or in waters frequented by ice.

As a first step in containment and recovery, the oil must be confined to minimize the area affected and to concentrate the product to a thickness which will enable recovery devices to operate. In offshore waters this requires the development of floating fences or booms. The various categories of booms are described by Logan, Thornton and Ross (1977). Trillo (1977) lists and describes oilspill containment and recovery systems worldwide. Other devices have been developed (eg. bubble and chemical barriers), however, these are generally not applicable offshore.

Although booms are available in a vast array of designs, all are limited in performance by wind, wave and current conditions. Booms can fail by either collapsing or permitting oil to pass by. If water currents are too strong, and are opposite to wind direction, the skirt, or submerged part of the boom, can resurface causing the skirt to lie flat on the water. Booms generally fail when currents exceed 1 knot. At a current speed of 1 knot the oil becomes entrained in the water and passes underneath the boom.

The U.S. Coast Guard has carried out the most extensive evaluation of booms for use in ice covered waters. Because of the force exerted by ice floes, even the large, cumbersome, heavy duty booms are judged to have only limited application in light and moderately broken ice fields.

In general, skimmers operate more effectively with greater thicknesses of oil. They tend, however, to emulsify fresh oil to some extent during the collection process. Their weakest link is usually the offloading pumping mechanisms. These mechanisms can be particularly ineffective in dealing with high-viscosity or weathered oil at low temperatures. The Framo is the most commonly used skimmer, however, the Canadian Coast Guard (Newfoundland) is testing additional heavy oil skimmers for offshore applications.

For any successful recovery operation, large on-site storage capacity is required. For offshore Labrador, tankers would be required to supply this capacity. During cold weather operations, steam coiled holds would be necessary for the recovery of heavier crudes. These tankers would need access to port facilities where recovered fluids could be offloaded for long-term storage.

The predominating conditions in the open ocean, particularly the Labrador Sea, are quite often harsh and unpredictable. The presence of high seas, high winds, ice and cold temperatures places severe restrictions on most of the conventional oilspill retaining and cleaning equipment presently available. It is not likely significant developments will occur in the research and development of offshore retaining/cleanup equipment. While harsh environmental conditions will render retaining/cleaning operations almost impossible, some of these same conditions may cause some of the toxic components to vaporize. The wave action may act as a natural dispersant, causing the slick to break down and detoxify to a certain extent. Should the oil migrate to a sensitive area inshore, the sheltered waters may facilitate the use of technology that would otherwise be impossible to deploy in the open seas.

PIII (b) Determination of the Fate and Behaviour of Oil in Pack Ice

Work on the fate and behaviour of oil in pack ice was carried out during the "Kurdistan" accident off the Cape Breton coast during the late winter/early spring of 1979. The "Kurdistan" spilled 1.5 million gallons of Bunker C oil. The observed behaviour of the oil from this spill differed somewhat from other spills, depending on prevailing weather conditions and the hydrocarbon involved. The behaviour of crude oil was examined in 1986 with an experimental spill in pack ice off eastern Nova Scotia.

Generally, pack ice tends to hold oil offshore. During the 1979 "Kurdistan" incident no oil contamination of the shoreline was observed in Gabarus Bay, Nova Scotia despite an estimated 260 tonnes of Bunker C present in the bay. The shoreline did not experience significant fouling until the often heavily contaminated ice melted.

Oil distribution in pack ice can vary considerably. Oil has been observed to collect in depressions on the bottoms of floes, and can also be thrown upon floes as spatters or pushed onto floe edges during extreme sea states. Oil that has been deposited onto the surface of floes would warm considerbly due to solar radiation. This would cause the ice underneath to melt. The oil would stretch and spread until surface tension breaks the blob apart to produce smaller sized oil particles.

Oil blobs that are not deposited onto the top of floes would be finely dispersed within the pack ice with relatively uniform distribution. These fine particles would tend to incorporate organic and mineral material into them. In addition to collecting in depressions on the bottom of floes and being thrown up on the tops of floes, oil deposits would be entrained in brash ice as a result of the impact and differential movement of the ice mass.

In general, ice and cold water will nearly eliminate weathering. Ice will tend to calm the water and thus eliminate tne mechanical degradation processes of wave action. In addition, it will act as a cap, preventing volatilization of the ligher fractions and shielding the oil from photochemical degradation.

While the behaviour and fate of Bunker C oil in pack ice has been documented, the behaviour of hydrocarbons has not. The effects of variables such as temperature, light, and other potential degradation processes still remain unanswered for no only Bunker C oil but other hydrocarbons as well. While a repeat of a "Kurdistan" - type of accident involving a different hydrocarbon is not necessary, modelling will be required to answer some of these questions.

PIII (c) Tracking of Oil in Pack Ice

Research has shown that spilled oil in pack ice tends to collect underneath the ice, making conventional airphoto tracking techniques unreliable where ground truthing is not feasible. Therefore, tracking an oil spill can be done by tracking oil-contaminated ice. Satellite or aircraft tracked buoys have been successfully used to track Bunker C oil which was spilled from the "Kurdistan" off Cape Breton island in 1979.

To allow a surveillance aircraft to find the exact position of ice flows and accompanying oil slicks, a homing device is required. High-frequency homing beacons have been developed for this purpose. The detector consists of a directional loop, a receiver and a relative bearing indicator mounted on an aircraft. These systems usually have a range of 10-50 km depending on flight altitude.

In addition, radar reflectors can be used to aid aircraft in locating oil contaminated ice. A passive radar reflector is essentially a radar antenna which reflects certain types of radiation. While this sytem has the advantage of no power source being required for the reflector, the size and shape of the reflector are critical. Consequently, performance will be seriously degraded by any accumulation of ice and snow.

Buoys can be implanted into the oil contaminated ice and transmissions received from these buoys are then detected by satellites, combined with other data and stored in a Global Tape Recorder (GTR). Data from the GTR is dumped at Command and Data Acquisition Stations located around the world. These receiving stations transmit the data to the National Environment Satellite Service. The data is then interpreted and the buoys' position calculated. The information is then made available to the user.

A possible alternative to satellite positioning is the use of land based radio directional systems which determine position by triangulation. This method has been used to track drifter buoys in oceanographic programs, and offers the advantage of collecting real-time information by way of an independent, self-contained operational system.

Tracking oil contaminated pack ice has been accomplished by using an array of detection systems. While these systems provide fairly accurate and reliable information of oil infested pack ice movements on a local level, methodologies are still required to develop a better understanding of the areal extent of the oil contamination. Satellite imagery is promising, and the fine-tuning of existing methodologies or the creation of new ones would further enhance oil in ice tracking capabilities. The systems would be able to detect oil infested ice under a variety

of surface and atmospheric conditions. Such information, when combined with buoy-tracking data, would provide users with a better understanding of the oil slick dynamics at the micro and macro level.

Present capabilities allow the oil to be tracked in a more direct way. Rather than tracking the ice, the oil itself can be monitored using a variety of technologies such as radio frequency devices, acoustic and nuclear techniques.

Radio frequency radiation, while being able to penetrate reasonable depths of ice, is highly attenuated in first-year ice and less so in multi-year ice at frequencies which would give the desired resolution. However, if a clear ice-oil boundary is present, that is no oil has migrated into brine channels, it would be possible, at least theoretically, to detect the presence of a layer of oil that is not very much thinner than the wavelength being used.

With regards to acoustic techniques, soundwaves penetrate reasonable ice thicknesses at wavelengths which are closely related to the oil thickness in question. The similar acoustic properties of water and oil (especially heavy oils), however, may cause difficulties in distinguishing between the two, and further study is required to establish feasibility.

Nuclear techniques, while providing the required resolution, appear to be fundamentally limited with regard to ice penetration. Expected penetration using current techniques would be approximately 40 cm, and even extensive and costly development might only improve this by a factor of two or three.

APPENDICES
(1 to 5)

APPENDIX 1

EACNLMT MEMBERSHIP

1. List of Members and Attendees

a. Members

Jim Osborne	Environment Canada	Co-Chairman
Bob Wiseman	Fisheries and Oceans	Co-Chairman
Bruce Moores	Environment Canada	Secretariat, A/Chairman as of April 9, 1987
Barry Jeffrey	Environment Canada	A/Secretariat as of April 9, 1987
Neil Roberts	Canadian Coast Guard	Ex-Officio
Victor McCauley	Indian Affairs and Northern Development	Observer
Richard Elliot	Environment Canada	
Stu Porter	Environment Canada	
Brian Nicholls	Fisheries and Oceans	
William Andersen III	Labrador Inuit Association	
Doug Brown	Nfld Dept. of Inter-Governmental Affairs	
David Jeans	Nfld Dept. of Environment and Lands	
Richard Hoos	Dome Petroleum Ltd., Arctic Petroleum Operators Association/ Canadian Petroleum Association	

b. Alternates

Judy Rowell	Labrador Inuit Association
Sharon Edmunds	Labrador Inuit Association
Richard Martin	Environment Canada
John Bursey	Environment Canada
Jennifer Jeans	Nfld Dept. of Inter-Governmental Affairs
Susan Bonnyman	Nfld Dept. of Environment
Joyce (Snyder) Lemon	Nfld Dept. of Environment
Eric Vespoor	Nfld Dept. of Environment
Ken Oakley	Canadian Petroleum Association
Laurie Taylor	Canadian Petroleum Association

c. Guests

K. Alexander	Panarctic Oils Ltd.
A. Churcher	Dome Petroleum Ltd.
B. Matchim	Canadian Coast Guard
B. Snow	Canadian Coast Guard
B. Ryan	Canadian Coast Guard
B. Nash	Canadian Coast Guard
T. Mullane	Environment Canada
C. McNeill	Labrador Inuit Association
T. Anderson	Labrador Inuit Association
W. Parr	Port Hope Simpson Community Council
S. Felsberg	Mud Lake Community Council

2. Current Addresses of Members (1989)

Mr. J. Osborne
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St. John's, NF
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Mr. B. Moores
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Environment Canada
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Mr. N. Roberts
Canadian Coast Guard
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Mr. V. McCauley
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Mr. R. Hoos
Amoco Canada Petroleum
Company Limited
Scotia Centre
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Calgary, Alberta
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APPENDIX 2

LIST OF EACNLMT MEETINGS

Date	Location
31 October 84	St. John's, Nfld (Northwest Atlantic Fisheries Centre)
17 July 85	St. John's, Nfld (Northwest Atlantic Fisheries Centre)
22 January 86	St. John's, Nfld (Northwest Atlantic Fisheries Centre)
24 June 86	Goose Bay, Labrador (Labrador Institute of Northern Studies Memorial University of Newfoundland)
21 November 86	St. John's, Nfld (Coast Guard Paramount Building)
9 April 87	St. John's, Nfld (Building 303, Pleasantville)
17 February 89	St. John's, Nfld (Northwest Atlantic Fisheries Centre)

APPENDIX 3

TERMS OF REFERENCE

Environmental Advisory Committee on Newfoundland & Labrador Marine Transportation

Purpose/Role

The purpose of the Environmental Advisory Committee is to provide, on request, information and advice to the Control Authority* on those aspects of the environment and natural resources which may be affected by shipping activity, so as to aid the Control Authority in the management of shipping routes and ship movement in the contiguous waters of Newfoundland & Labrador.

Membership

The membership shall include senior representatives of the Department of Fisheries & Oceans, the Department of Environment, the Department of Transport (CCG) (the CCG member shall have ex-officio status), and the Government of Newfoundland and Labrador. The Department of Indian Affairs and Northern Development will have observer status.

Industry, other agencies and groups (eg. Labrador Inuit Association, Naskaupi Montagnais Innu Association and Newfoundland and Labrador Fishermens Union) may be admitted upon request of the Committee to address issues as required.

Each member may be accompanied by one observer as and when appropriate.

Chairmanship

The senior representatives of DFO and DOE shall Co-Chair the Committee. This arrangement shall be reviewed as the role of the Committee developes.

* Control Authority is Canadian Coast Guard Newfoundland Region.

Meetings

The frequency and locations of Committee meetings will be determined by the Chair in consultation with members, where feasible and appropriate.

Secretariat

The Secretariat of the Committee shall be provided by DOE, St. John's with support from DFO, St. John's.

Financial

The costs incurred in attending Committee or Working Group meetings shall be borne by the respective parties.

Working Groups

The Committee may establish and utilize working groups comprised of specialists from government, and other groups in order to facilitate its deliberations on selected matters. The Committee shall develop appropriate terms of reference for the working groups it establishes.

Responsibilities

1. To provide a forum for consultation between government, native groups, industry and others on relevant environmental and resource use activities relating to the management of shipping routes and ship movement in the contiguous waters of Newfoundland & Labrador.

2. At the request of the Control Authority, to review marine shipping proposals and determine the attendant potential implications for the environment and for natural resource users.

3. To recommend mitigative measures and guidelines for shipping routes and ship movement in the contiguous waters of Newfoundland & Labrador, which recognize environmental sensitivities, environment-shipping interactions, and natural resource uses and minimize environmental risks.

4. To identify environmental information data gaps, and make recommendations on areas of research which should be addressed by government and/or industry.

5. To advise and consult with the Control Authority on all matters of mutual concern.

Exclusions

1. Exploration, delineation and production activities for offshore oil and gas shall not be considered under the terms of reference of this Committee.

2. The work of the Committee shall not in any way supplant or interfere with existing operational linkages.

Amendments

1. These terms of reference may be amended by mutual agreement of the Committee members, in consultation with the Control Authority.

2. The mandate of the Committee shall be assessed within eighteen months of its establishment.

TERMS OF REFERENCE

Control Authority

1. General

The Control Authority is established by the Canadian Coast Guard in response to recommendations of an interdepartmental committee for the establishment of an Environmental Advisory Committee on Newfoundland and Labrador Marine Transportation.

2. Purpose

The purpose of the Control Authority is to provide a forum for the receipt of environmental and related advice and concerns from the Environmental Advisory Committee (EAC), and to integrate that advice into the planning framework for management of shipping routes and ship movements in contiguous waters of Newfoundland and Labrador.

3. Development Phase

While the Coast Guard has various control and advisory systems currently in place, it should be recognized that the "Control Authority" structure is currently being developed and that the cooperation and willing participation of industry, Native Groups and others is essential in administering effective Vessel Traffic Systems.

4. Role

The role of the Control Authority is to plan for the management of shipping routes and ship movements, and to provide guidance to the individual Coast Guard Managers with related program responsibilities.

5. Area of Jurisdiction

The area of jurisdiction is the contiguous waters of Newfoundland and Labrador in which Canada exercises shipping control authority.

6. Membership

The Control Authority is chaired by the Regional Director General of the Canadian Coast Guard, St. John's, Newfoundland and comprises the following Coast Guard members:

Regional Manager, Ship Safety
Regional Manager, Aids and Waterways
Regional Manager, Fleet Systems
Regional Manager, Telecommunications and Electronics
Regional Manager, Search and Rescue
Regional Manager, Emergency Operations
Coast Guard member (Ex Officio) of EAC

Ex-officio member:

Co-Chairman of the Environmental Advisory Committee on Newfoundland and Labrador Marine Transportation.

7. Ex-Officio Members of Environmental Advisory Committee, On Newfoundland Marine Transportation.

The Director General or his delegate is an ex-officio member of the Advisory Committee.

8. Meeting

The frequency of meetings will be determined by the Chairman, in consultation with the EAC Co-Chairmen.

9. Secretariat

The Secretariat of the Committee will be provided by the Director General, Canadian Coast Guard.

10. Responsibility

The Control Authority in fulfilling its purpose shall have the following responsibilities:

(a) To manage systems and support services for the shipping routes and ship movements in contiguous waters of Newfoundland and Labrador;

(b) To develop guidelines and systems for and with the EAC, in developing the most effective format, for the transmission of environmental information and advice;

(c) To receive, consider and whenever agreed, act upon the advice and concerns expressed by the EAC;

(d) To discuss with EAC Co-Chairmen the studies proposed or underway, lending support or guidance as requested;

(e) To present problems or proposed solutions to the EAC, for consideration or evaluation;

(f) To review and respond to additional significant marine traffic proposals after, as required, referring these to the EAC for analysis and advice;

(g) To provide a focus of response, to queries and concerns regarding the management of shipping routes and ship movements in contiguous waters of Newfoundland and Labrador.

APPENDIX 4

SURVEY QUESTIONNAIRE AND RESPONSE SUMMARY

POTENTIAL ISSUES AND CONCERNS ASSOCIATED WITH SHIPPING OIL AND GAS THROUGH THE LABRADOR SEA AND THE STRAIT OF BELLE ISLE

SURVEY RESULTS

	IMPORTANCE		
	HIGH	MEDIUM	LOW
A. SHIPPING APPROVALS	%	%	%
1. How important is it that the approval system for shipping oil and gas in Labrador waters be the same as it is for shipping in Artic waters?	80	17	3
2. Who controls shipping of oil and gas through the Labrador Sea and the Strait of Belle Isle?	73	17	10
3. What does a shipping approval grant, and what does it require of the ship owner and Captain?	73	23	4
4. What requirements will there be for tankers not flying the Canadian flag?	67	20	13

Additional questions:

B. TANKER MOVEMENTS

1. Will there be a tanker control authority to regulate all tanker movements?	83	7	10
2. What will be the frequency and timing of tanker movements?	73	17	10
3. What will be the ports and the tanker route(s) throughout the year?	50	36	14

Additional questions:

- Should the speed of the tankers be controlled by the captain when sailing through the Strait of Belle Isle? In clear weather and especially when visibility is poor small fishing boats in the area sometimes cannot be seen on radar?
- Will the shipping passage be outside the 200 mile limit?
- Is it necessary to ship gas and oil down the Labrador Sea and Strait of Belle Isle?

	IMPORTANCE		
	HIGH	MEDIUM	LOW
C. TANKERS SIZE AND SAFETY			
1. Will the tankers be tested and, if so, what safety requirements will they have to meet?	97	3	0
2. What is the possibility of an oil spill?	93	3	4
3. What will be the ice-breaking and iceberg detection capabilities of the tankers?	87	7	3
4. How much is known about the weather/sea/ice conditions in the Labrador Sea and the Strait of Belle Isle, and is it enough for safe tanker movements through the year?	87	3	10
5. How experienced will the captain and crew be in sailing waters like the Labrador Sea and the Strait of Belle Isle?	83	17	0
6. How do these future tankers compare in all regards with existing tankers using the Labrador Sea and the Strait of Belle Isle?	70	27	3
7. Are the existing navigation charts adequate for the proposed route(s)?	63	34	3
8. What size will the tankers be, and how manoeuverable will they be?	60	27	13

Additional questions:

- Will the tankers have special hours like 12:00 midnight to 4:00 a.m. to maneuver through the Strait of Belle Isle?

- Will tankers be regulated to slow speed while passing through the Strait of Belle Isle?

- Will the tankers be equipped with high tech equipment capable of detecting small fishing boats and be able to navigate within the tanker's routes without being thrown off course by wind and tides?

- Will there be a continuous report re fisherman's broadcast on tanker movement?

- Will there be a regular tanker season?

- Does the Environmental Protection Service of Environment Canada think it is safe to be shipping oil and gas before all environmental impact studies are completed?

	IMPORTANCE		
	HIGH	MEDIUM	LOW
D. TANKER DAMAGE			
1. If a tanker were damaged and oil spilled:			
- what effects would the oil have on the resources such as birds, fish, seals and whales;	100	0	0
- where would the oil likely be carried by winds and currents (from various locations in the Labrador Sea and the Strait of Belle Isle);	94	0	6
- what effects would this have on the people who hunt and fish in the area;	90	10	0
- what would be done:			
- to clean up the spilled oil at sea	90	10	0
- if it reaches shore?	97	3	0
- to minimize the spillage;	87	10	3
- what effects would the oil have on historical and archaeological sites (e.g. at Red Bay and L'Anse aux Meadows);	60	23	17
2. If a tanker were damaged and sank, what would be done?	89	11	0
3. If a tanker were damaged (e.g. collision with an iceberg, broke down or went aground), but no oil spilled, what would be done?	73	24	3

Additional questions:

- How much is known in regard to ocean current direction for the Labrador Sea in the case of an oil spill?
- If a tanker's cargo was punctured in the Strait of Belle Isle in mid-winter by heavy pack ice (5/10 to 10/10 coverage) causing an oil spill, what can be done to save fish or should any tanker use the Strait of Belle Isle during winter from January to April (very important)?

	IMPORTANCE		
	HIGH	MEDIUM	LOW
E. REPORTING OF OIL SPILL			
1. How much oil would have to be spilled from one of the tankers for the Captain to be required to report it to the authorities, or would he be required to report any amount of oil spilled from his ship?	97	0	3
2. Who receives these reports, and how quickly must they be prepared?	83	17	0
F. CONTINGENCY PLANS			
1. Is there adequate rapid response capability along the proposed route(s) in the event of a spill?	90	10	0
2. What kind of contingency plans exist or are required?	77	20	3
G. ENVIRONMENTAL PROTECTION LEGISLATION			
1. What is the existing environmental protection legislation relating to tanker movements in the Labrador Sea and the Strait of Belle Isle?	88	6	6
2. Are the regulations the same north and south of 60° North latitude (Cape Chidley)?	70	20	10

Additional questions:

Additional questions:

- What plans do they have for an oil spill on water or land?
- Do they have any ships on standby for oil spills?
- If there is a spill, would all communities on the Labrador coast be notified?

Additional questions:

	IMPORTANCE		
	HIGH	MEDIUM	LOW
H. TANKER EFFECTS			
1. What effects, if any, have existing levels of tanker traffic had on the environment, or on the birds, fish, seals and whales of the Labrador Sea and the Strait of Belle Isle?	67	23	10
2. What effects, if any, have existing levels of tanker traffic in the Labrador Sea and the Strait of Belle Isle had on the traditional lifestyles of the local people?	63	23	14
3. What would be the impact of the creation of leads through the ice on marine life, or on the traditional lifestyle of the local people?	60	30	10
4. Will there be a monitoring program to determine if the presence or noise of the tankers have any significant effects on the environment, or on the birds, fish, seals or whales of the Labrador Sea and the Strait of Belle Isle, or on the traditional lifestyle of the local people?	53	27	20
5. Will the presence or noise of the tankers have any effects on the environment, or on the birds, fish, seals and whales in the Labrador Sea and the Strait of Belle Isle and, if so, what are they anticipated to be?	33	37	30
6. How much noise will these tankers make, and how does this compare with the noise generated by current shipping in the Labrador Sea and the Strait of Belle Isle?	27	43	30

Any questions:

- Will the ship's Captain see a man on the ice when sailing through the Strait of Belle Isle?

	IMPORTANCE		
	HIGH	MEDIUM	LOW
I. MARINE SERVICES			
1. Are existing marine services (e.g. weather and ice forecasting; search and rescue; oil spill response; and marine communications) adequate for the proposed tanker traffic?	97	3	0

Additional questions:

- Will all the present light stations be fully manned as is?
- If light stations go automated, will this be a good system?
- How fast can search and rescue get to the scene of a sinking ship?
- Should there be a Loran station close to the narrow point at the Strait of Belle Isle?

J. COMPENSATION

1. If there were an oil spill, or other effects, from the tankers, which are believed to have a negative effect on the environment, or on the birds, fish, seals or whales of the Labrador Sea or the Strait of Belle Isle (i.e. damage of an attributable nature):			
- what kind of liability would have to be proved;	90	10	0
- what procedures would have to be followed to claim compensation;	90	10	0
- who would be accountable, and what kind of compensation would there be;	87	13	0
- what would be done to alleviate any associated hardship while waiting for the compensation; and	80	17	3
- approximately how long would it take to receive the compensation;	73	27	3
2. In the case of damage which cannot be attributed to a particular tanker (i.e. damage of a non-attributable nature), what are the answers to the questions listed in 1. above?	90	7	3
3. Will the requirements for compensation be the same north and south of 60°N latitude (Cape Chidley)?	80	17	3

Additional questions:

- If there was an oil spill and in case of damage to fishing gear or hardship to the people on the coast before the environmental impact studies are completed, who is accountable? Where do people go for compensation?

- All of the above questions are important - but is an ounce of prevention worth more than compensation?

	IMPORTANCE		
	HIGH	MEDIUM	LOW
K. BUSINESS AND EMPLOYMENT OPPORTUNITIES			
1. Will there be any business, employment or training opportunities for local people associated with the shipping of oil and gas through the Labrador Sea and the Strait of Belle Isle, e.g.:			
- weather and ice forecasting;	83	14	3
- oil spill countermeasure stations;	80	17	3
- environmental studies;	80	13	7
- on board the ships; and	77	20	3
- ship traffic control;	77	20	3

Additional questions:

- Will employment be also for female applicants?

L. CONSULTATION			
1. What is the role of government and industry in helping local people prepare for tanker traffic?	83	10	7
2. What is the role of the local people in preparation for and management of tanker traffic through the Labrador Sea and the Strait of Belle Isle?	73	20	7

SURVEY RESPONDENTS	LOCATION
Inuit Committee on National Issues	Nain
Town Council	Nain
Community Council	Makkovik
Town Council	Northwest River
Fishermen's Committee	Northwest River
Mokami Regional Development Association	Happy Valley/Goose
Improvement Committee	Mud Lake
Local Service District	Black Tickle
Community Council	Mary's Harbour
Producers' Co-op Society	Red Bay
Fishermen's Committee	Red Bay
Fishermen's Committee	West St. Modeste
Community Council	West St. Modeste
Fishermen's Committee	Capstan Island
Lab. Fishermen's Union Shrimp Co. Ltd.	Lanse au Loup
Eric O'Brien	Lanse au Loup
Community Council	Lanse au Loup
Community Council	Forteau
Fishermen's Committee	Forteau
Community Council	Lanse au Clair
Community Council	Raleigh
Community Council	Cook's Harbour
Fishermen's Committee	Green Island Brook
Fishermen's Committee	Green Island Cove
Community Council	Sandy Cove
Fishermen's Committee	Savage Cove
Fishermen's Committee	Flower Cove
Community Council	Anchor Point
Fishermen's Committee	Straitsview
Central Development Association	Parsons Pond

APPENDIX 5

LIST OF ACRONYMS

AWPPA	Arctic Waters Pollution Prevention Act
CCG	Canadian Coast Guard
DFO	Department of Fisheries and Oceans
EACAMT	Environmental Advisory Committee on Arctic Marine Transportation
EACNLMT	Environmental Advisory Committee on Newfoundland and Labrador Marine Transportation
LIA	Labrador Inuit Association